

# A system dynamics approach for water resources management with focusing on domestic water demand

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## Abstract

**Background:** Due to the complexity and interdependence of water resources, the evaluation of the efficiency of water resources management is difficult. So, it is necessary to use effective modeling methods to study and recognize the feedback loops available in water resources systems. Regarding the importance of domestic water for the human health, the aim of this study was to develop a dynamic model with focusing on domestic water management.

**Methods:** This study was performed using a system dynamics approach. The strategies used in this study include population scenarios (ps), water use education scenarios (wu education), and agricultural water management scenarios (Agriwm).

**Results:** There was a significant relationship between education on water saving in domestic sector and water use per capita. In various scenarios of population growth, domestic water use was declined rapidly with education. According to the obtained results, under “ps3-wu education” scenario, lower population growth, and higher water use education, domestic water use will reach the minimum level, by 2041. The results showed that the proposed scenarios can lead to 60% reduction in domestic water use.

**Conclusion:** With education strategy, water use per capita up to 2024 can reach the optimum level of 100 liters per person per day. However, without education even by 2041, this goal is unattainable. So, sustainable goals can be achieved by adopting education strategy. The developed systematic model can be applied in various conditions. In each study area, the regional water and population data should be provided.

**Keywords:** Water resources, Population growth, System dynamics, Water use education, Agricultural water management scenarios (Agriwm)

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## Introduction

Population growth and urbanization have increased the need for domestic water, food safety, and environmental protection, agricultural, industrial, and commercial water. Furthermore, safe drinking water is one of the necessities to sustain life, and a satisfactory (adequate, safe, and accessible) supply of water must be available for all people (1,2). According to the new global attitude, water is a socio-economic commodity and it is considered as the primary and vital need of every human being (3). Although, water is a renewable resource, but the amount and speed of this process is very low, slow and long. With regards to the rapid population growth, raising the level of public health and welfare, water resources per capita are declining. Given the current situation in third world countries and the rapid growth of population and urbanization, increased water

use in developed countries, and political tensions around the world are limiting factors for access to adequate water resources (4). So, water scarcity and lack of adequate and proper water resources in different parts of the world has been warned by various international organizations such as the World Bank (5) and the World Health Organization (6). One of the ways to control water crisis and droughts is proper water management with regard to water demand management. Water demand management refers to activities that help reduce water demand and water use efficiency and prevent contamination or destruction of resources. In water resource management should pay more attention to water demand management. Water demand management is a difficult variable to influence due to the pressure of uncontrolled factors, such as weather conditions, population growth, and urbanization

